HP P4459A 8-Port Fibre Loop Switch Installation & Operation Guide

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Audience Assumptions

This Installation and Configuration Guide is for the person who installs, administers, and trouble-shoots LAN servers. Hewlett-Packard Company assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.

Safety Instructions

The following sections describe the symbols used on the fibre loop switch and within this guide and also provides safety information about the product:

- Symbols Used on Equipment
- Symbols in Text
- Grounding Requirements

Symbols Used on Equipment

The following table describes the symbols that are used on the fibre loop switch.

Any surface of area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

Warning: To reduce risk of injury from electrical shock hazards, do no open this enclosure.

This product is a safety Class I product which has a protective earthing terminal. There must be an uninterrupted safety earth ground from the main power source to the product's input wiring terminal, power cord(s), or supplied power cord set(s). Whenever it is likely that the protection has been impaired, disconnect the power cord(s) until the ground has been restored.

APPARATEN SKALL ANSLUTAS TILL JORDAT NÄTTUTAG.

Symbols in Text

The following symbols are used in the following formats to highlight special messages throughout this guide:

Note: This format is used to highlight information of importance or special interest.

Caution: This format is used to highlight information that will help you prevent equipment failure or loss of data.

Warning: This format is used to highlight material involving possibility of injury or equipment damage.

Danger: This format is used to alert you that you can incur an electrical shock by mishandling equipment.

This product is a safety Class I product which has a protective earthing terminal. There must be an uninterrupted safety earth ground from the main power source to the product's input wiring terminal, power cord(s), or supplied power cord set(s). Whenever it is likely that the protection has been impaired, disconnect the power cord(s) until the ground has been restored.

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Contents

Preface

The fibre loop switch provides an affordable entry-level SAN switch with multiple connectivity options. This guide provides information about the features and capabilities of the fibre loop switch, and how to install it.

Related Publications

The following publications provide information regarding Storage Area Networks (SANs) and the Fibre Channel protocol.

Building Storage Networks, Farley, Marc, Osborne/McGraw-Hill, 2000. ISBN 0-07-212-050-9.

Fibre Channel Arbitrated Loop, Kembel, Robert W., Tucson, Arizona: Connectivity Solutions, a division of Northwest Learning Associates, Inc., 1996. To order, call 1-520-881-0877 in the USA.

Fibre Channel - Gigabit Communications and I/O For Computer Networks, Benner, Alan F., McGraw-Hill, 1996.

Fibre Channel, Volume 1: the Basics, Jan Dedek and Gary Stephens, ANCOT Corporation, 115 Constitution Drive, Menlo Park, CA 94025, 1997.

The Simple Book, An Introduction to Management of TCP/IP-based Internets, Marshall T. Rose, Prentice Hall, 1992.

What Is Fibre Channel? Jan Dedek and Gary Stephens, ANCOT Corporation, 115 Constitution Drive, Menlo Park, CA 94025, November 1996.

Related Web Sites

These web sites, among others, provide significant information regarding SANs and the Fibre Channel protocol.

Table 1: **Related Websites**

Site	URL
ANSI	http://www.ansi.org/docs/home.html
Fibre Channel Industry Association	http://www.fibrechannel.com/
Storage Network Industry Association	http://www.snia.org/

Chapter 1
Introducing the HP P4459A
8-Port Fibre Loop Switch

The following sections of this chapter provide an overview of the features and functions of the fibre loop switch:

- Fibre Loop Switch Features
- Switching Operation

Fibre Loop Switch Features

The fibre loop switch features an integral 12Gb/sec. engine that enables full duplex, concurrent switching on all ports.

Additional features of the fibre loop switch are described in the following sections:

- GBIC Ports
- Front Panel LEDs

GBIC Ports

The fibre loop switch is designed for maximum flexibility. It contains eight GBIC ports that can be configured to support copper, short-wave multimode fiber, and long-wave single mode fiber media connections. Because each of these media options provide different price/performance characteristics, you can mix and match GBICs to meet the needs of your storage network now, and add or exchange GBICs in the future as your network changes.

Figure 1: Front View of the Fibre Loop Switch

Power
Connector

GBIC Ports
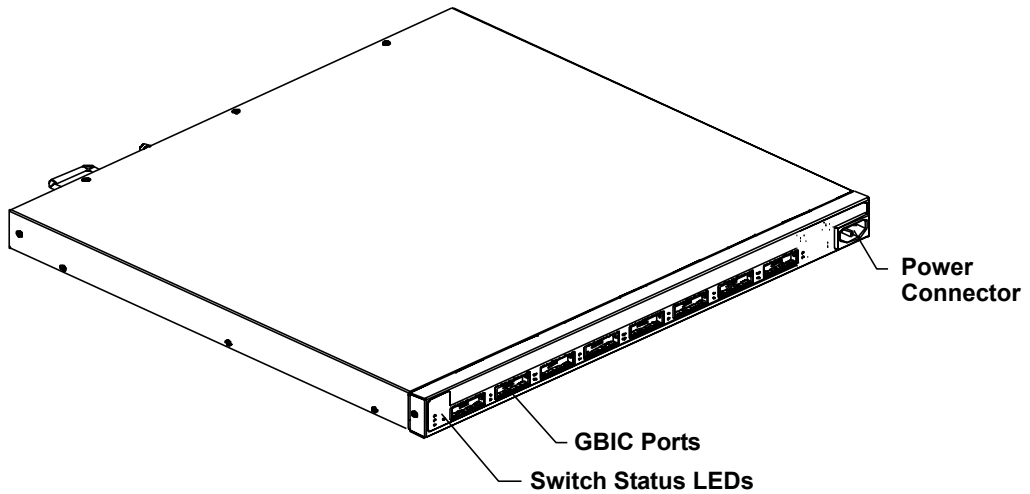
Switch Status LEDs

Front Panel LEDs

In addition to the port connectors, the front panel of the fibre loop switch contains LEDs that provide diagnostic information for both switch and port status, and an IEC power plug connector. Figure 2 shows the locations of the LEDs and the power plug connector.

Figure 2: Fibre Loop Switch front panel
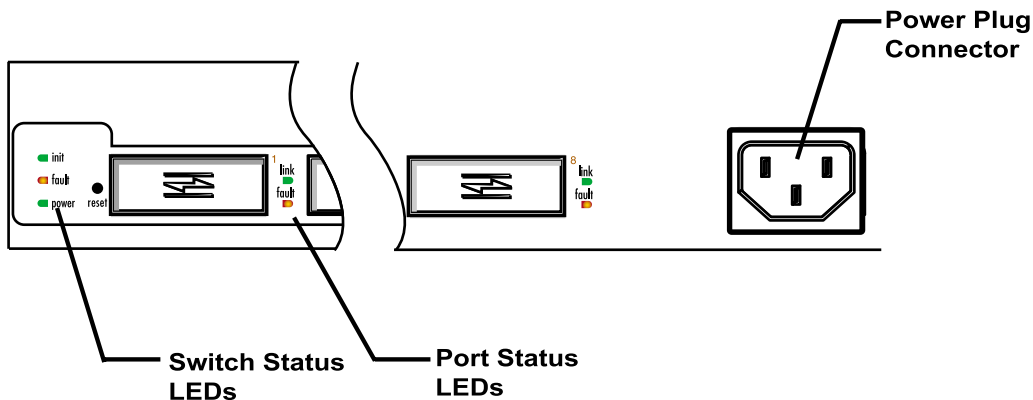
Table 1 describes the operation of the switch LEDs and Table 2 describes the operation of the port LEDs on the front panel of the fibre loop switch.

Table 1: Fibre Loop Switch LEDs

Name	Color	Function
fault	Amber	Indicates that the switch is running a self-test during start-up, or a failure occurred.
power	Green	Indicates that power is on to the switch.

Table 2: Port LEDs

Name	Color	Function
Link	Green	Indicates that a good physical link has been established.
Fault	Amber	Indicates that faulty data is being received on the port.

Switching Operation

The fibre loop switch implements the Fibre Channel Arbitrated Loop protocol. It provides concurrent connections to the storage area network (SAN) without changing the FC-AL interface, which most SAN end-node devices normally communicate.

The SAN operation changes dramatically when comparing a switch with a hub environment. The normal operation, as seen by a single end-node device, does not change, other than a rapid acceleration of responses in a switch environment. Figure 3 illustrates how the fibre loop switch alters the response speed without changing the nature of the responses seen by a participating node.

Figure 3: Switching Using Fibre Channel Protocol
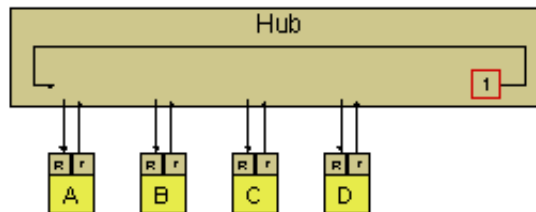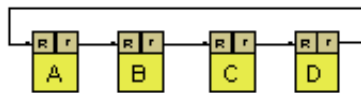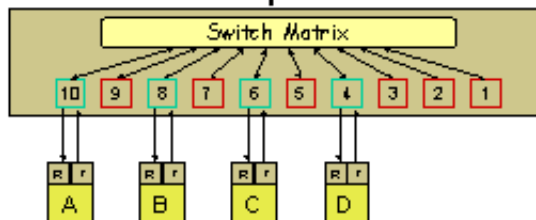
The fibre loop switch maintains signal and data integrity by re-timing and re-amplifying the signal at each port. The data-path routing, however, is significantly different in the switch than with a hub.

As shown on the top of Figure 3, a Fibre Channel network has a physical loop structure. All traffic must go through all nodes. Since the physical media is shared by all nodes, the bandwidth must be partitioned between any nodes that

wish to communicate. The addition of a hub, as shown in the center of the same figure, merely allows the cables from each node to go to a centralized location, such as a wiring closet where the hub is located. The media and bandwidth on that port are shared.

The fibre loop switch has been designed with a non-blocking switch backplane; there is enough switch matrix bandwidth available to support simultaneous conversations between many nodes. The fibre loop switch helps reduce the time arbitration and loop initialization required in an active FC network. The fibre loop switch also supports an initialization agent called P4459A Name Server. These features are explained in the following sections:

- Fibre Channel Arbitration in the Fibre Loop Switch
- Fibre Loop Switch Initialization

Fibre Channel Arbitration in the Fibre Loop Switch

Normal Fibre Channel data traffic operation is constrained by *loop tenancies*. A loop tenancy is the time required for a complete data transfer. An FC node wanting to send data starts a loop tenancy by arbitrating for ownership of the loop. Upon winning arbitration, the device wanting to send data opens a communication channel to its intended destination. When the destination device responds that it has available buffer space, the sender sends data until it is finished. After the data transfer is complete, the sender closes the loop tenancy.

An example: node C wants to send data to node A. The first step is that node C issues an arbitrate message. In a physical or hub-based Fibre Channel network topology, the arbitrate message has to circulate through nodes D, A, and B. Any of those nodes are capable of replacing C's arbitrate message with its own higher-priority message, resulting in node C losing arbitration. Thus, any of the other nodes wanting to communicate interfere even though neither node A or C are involved with their activity.

In the switch implementation, however, node C always wins arbitration. The only issue is whether node A is already active with a third node. If it is, node C has to wait, but the wait is only for as long as node A remains active. Three different scenarios are explained below:

- If node A is free, node C's data is forwarded directly to node A without interference. That is, the messages do not circulate through each device on the loop and so latency savings on this transaction are also gained. Note that all transactions are directed between the two communicating nodes. No traffic ever circulates the entire network as it would in a loop topology.

- If node A is busy with another loop tenancy, the open message from node C is held until that loop tenancy is completed. Holding the open message until node A is free sounds extreme until one considers the latency around a normal loop operation with a high number of nodes. The time just for one open message to circulate around a large loop (greater than 60 nodes) and get back buffer credit is actually greater than the completion of an entire loop tenancy transferring a single maximum frame across the switch. The relative time difference is on the order of a magnitude (tens of microseconds vs. tens of milliseconds).

- If A is busy and B, C, and D all simultaneously want to send data to A, a first-come, first-serve algorithm is enforced. This enforcement is realized due to the prioritized queueing of open messages at the destination. If the queue is greater than a programmable value, the switch responds with a close message to all subsequent open requests from other nodes.

Fibre Loop Switch Initialization

The initialization behavior of the fibre loop switch is encompassed within an intelligent agent referred to as P4459A Name Server. P4459A Name Server virtualizes the entire initialization process and eliminates the lengthy login procedure found on other switches.

In a hub-based Fibre Channel network, any device generates Loop Initialization Protocol (LIP) messages to notify the other devices on the loop that initialization needs to occur. During the LIP process, each port in turn receives the LIP sequence and retransmits the LIP. This process continues until the LIP sequence returns to the initiating port. Since port addresses are assigned during the LIP process, no "real" work is performed on the loop while it is underway. Therefore, it is wise to have a measure of visibility and control over LIP generation. This is the advantage of P4459A Name Server. It limits the effects of a LIP on other devices in the network.

Generally, a new node requires some period of time to become ready to participate on the network. The switch does nothing until the end node signals

that it is ready to participate by sending a LIP. Obviously, this interrupts any traffic in progress on that switch port, or on another switch port that is involved in a connection with a device on that switch port. However, it need not disrupt communications on any other switch port. Upon receiving a LIP, the switch conducts a series of passive tests on the new node, to verify that it is well-behaved.

Chapter 2
Installing the Fibre Loop Switch

The following sections of this chapter provide detailed instructions for installing a fibre loop switch:

• Unpacking the Fibre Loop Switch

• Installing and Removing GBICs in the Fibre Loop Switch

• Rack Mounting the Fibre Loop Switch

• Powering up a System

• Cabling for the Fibre Loop Switch

> **Note:** Only trained personnel should install a loop switch. Please read all instructions fully before performing the installation.

Unpacking the Fibre Loop Switch

The fibre loop switch comes packed in a single, integrated shipping box. Retain the box to reship the switch if necessary. Included are the following items:

• A fibre loop switch

• This *HP P4459A 8-Port Fibre Loop Switch Installation & Operation Guide*

• Two power cords

• Two HSSDC copper GBICs

• An HSSDC cable

• A rack mount kit

If any parts are missing, contact your sales or service representative.

Installing and Removing GBICs in the Fibre Loop Switch

Each port that you plan on using on the fibre loop switch must be configured with an HP-supported GBIC to provide media connectivity. Depending on the GBIC installed, connectivity options include copper and short-wave multi-mode fiber. Because each switch port can be configured with any GBIC, you can configure your switch for a variety of different media options to support your fibre channel architecture.

➡ **Note:** GBICs are hot-pluggable. This means that they can be installed and removed during operation, while the switch is running.

The following sections describe:

- Installing a GBIC
- Removing a GBIC

Installing a GBIC

The following procedure describes how to install a GBIC into a switch port.

⊖ **Caution:** GBICs are sensitive to static electricity. Static discharge from your clothing or other fixtures around you can cause damage. To prevent damage to the GBIC, wear a wrist strap or discharge leash to free yourself of static before touching it.

1. **Holding it by its edges, remove the GBIC you are installing from its antistatic bag.**
2. **Orient the GBIC in relation to the port you are installing it in so that the label side (or arrow) is on top.**

   If your GBIC doesn't have a label or an arrow to help you orient it, examine the D connector on it. The wider side of the D-connector should be on top. Figure 4 shows the orientation for installing a GBIC into a switch port.

Figure 4: GBIC Orientation
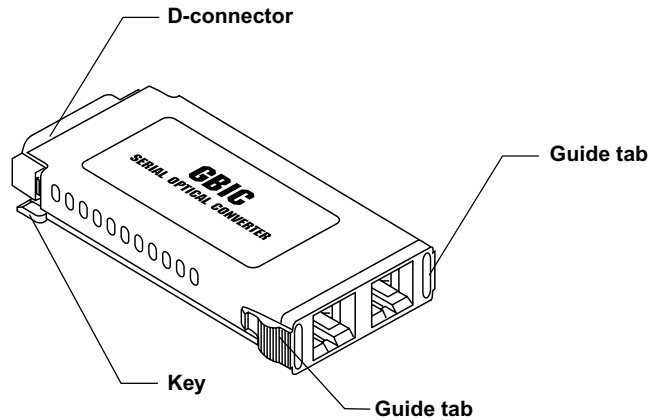
3. **Slide the GBIC through the port door and plug it into the 20-pin connector (not visible) on the host circuit board until it is firmly seated.**
   If the GBIC does not install easily into the port, do not force it. Instead, try removing it and inverting the GBIC's orientation.

> ⚠ **Warning:** Do not look directly for the GBIC laser source. Laser beams can be harmful to your eyes.

4. **If you are not going to install cabling immediately, leave the supplied protective plug in place.**
   The protective plug is used to shield the laser from view and to protect the optical components from dust.
5. **Repeat steps 1 through 4 for all GBICs that you want to install.**

Removing a GBIC

The following procedure describes how to remove a GBIC:

1. **Remove any cables attached to the GBIC.**
   Stressing the cable during GBIC removal might break it.

2. **Squeeze the latch levers (on the GBIC) together and pull the GBIC straight out.**

➡ **Note:** GBIC latching mechanisms vary by manufacturer.

Rack Mounting the Fibre Loop Switch

The following sections provide information and procedures on how to rack mount the fibre loop switch.

⚠ **Warning:** Reduce your risk of electric shock or damage to equipment by following these precautions:
- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.
- Plug the power cord into an easily accessible, grounded electrical outlet. Because there is no power switch, you can turn power on and off by plugging in and disconnecting the power cord.
- Disconnect the power from the unit by unplugging the power cord from either the electrical outlet or from the detachable plug on the unit.

Rack Installation

The fibre loop switch is designed to mount into a standard 19-inch rack up to 36 inches deep. Refer to the instructions included in the rack mount kit before attempting to mount the fibre loop switch. Only trained personnel should install the rack mount kit. Please read all instructions before installing the rails and sleeves.

⊖ **Caution:** The air vents along the side and back panel of the fibre loop switch must not be blocked when installed. The operating temperature must be kept between 10 and 40 degrees Celsius (between 50 and 104 degrees Fahrenheit).

Rack Installation Basics

Caution: Do the following to prevent the rack enclosure from tipping over. Failure to take these precautions could result in serious injury and equipment damage.

- Extend the anti-tip foot, or verify that the anti-tip feature is installed.
- Verify that the leveler feet are lowered.
- Do NOT extend more than one piece of equipment at a time out from the front of the rack.

Always keep the following safety and environmental issues in mind:

- **Maximum Recommended Ambient Temperature:** The maximum recommended ambient temperature of the room is 35°C (95°F).

- **Elevated Operating Ambient Temperature:** The ambient operating temperature within a closed or multi-unit rack assembly may exceed the room's ambient temperature. Make sure that the temperature within the rack itself does not exceed 35°C (95°F).

- **Air Flow:** As you mount equipment in the rack, make sure that you allow enough air flow for safe operation of the equipment.

- **Mechanical Loading:** Uneven mechanical loading within the rack can cause hazardous conditions. Plan the placement of equipment in the rack to avoid this problem.

- **Circuit Overloading:** Make sure that the total configuration of equipment in the rack does not overload the supply circuit. To verify this, check the nameplate ratings on all equipment. Consider the effect of circuit overloading on over-current protection and supply wiring.

- **Reliable Earthing (Grounding):** Maintain reliable earthing (grounding) of rack-mounted equipment. Give particular attention to supply connections that are not direct connections to the branch circuit (the use of power strips, for example).

- **Installation Order:** Begin installing components at the bottom of the rack.

Rack Installation Overview

The instructions in this guide are specifically for Hewlett-Packard rack enclosure product numbers J1464A, J1466A, J1487B, J1488A, J1500A, J1501A, and J1502A. For information about other rack installations, see the rack-mount kit

instructions that come with your rack or HP NetServer, or refer to the following web site:

```
http://www.hp.com/racksolutions
```

➡ **Note:** The installation instructions that follow use "left" and "right" to refer to rack columns as viewed from the rear of the rack.

Figure 5 and Figure 6 present a visual summary of the switch's rack-mounting hardware.

Figure 5: Mounting in HP Systems Racks
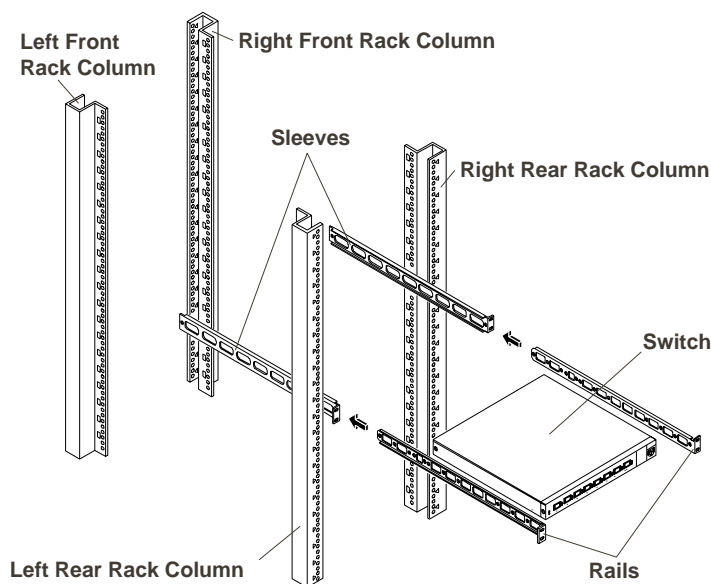
Figure 6: Mounting in HP Rack System/E and HP Rack System/U Racks

Left Front
Rack Column

Right Front Rack Column

"L" Spacer

"R" Spacer

Sleeves

Right Rear Rack Column

Switch

Left Rear Rack Column

Rails
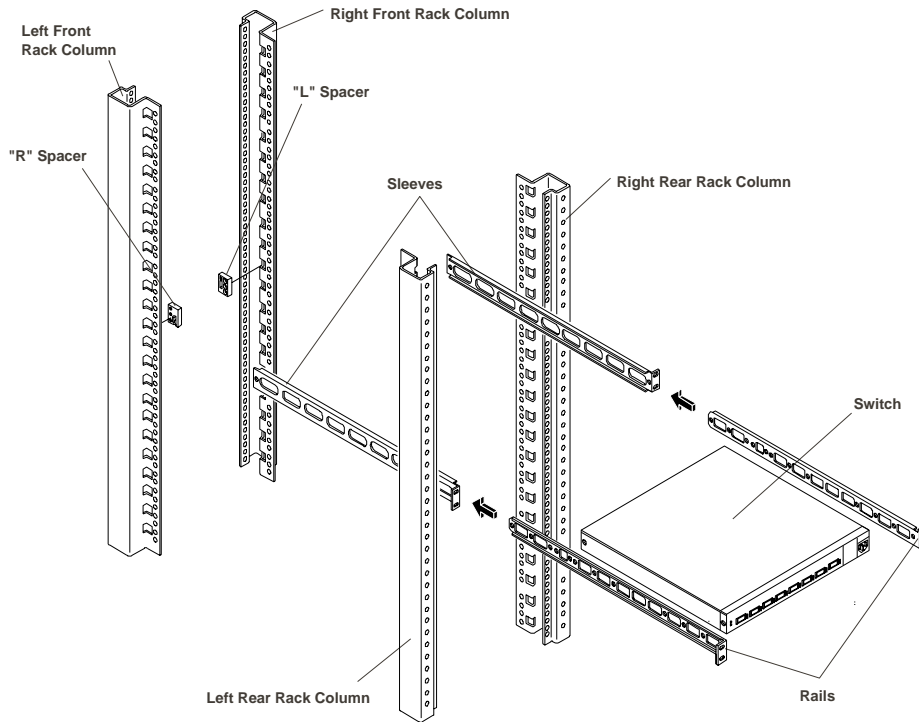
Tools Required

To install the switch in an HP rack, you need a T25 Torx driver and a #1 Phillips-head screwdriver.

HP Rack Mounting Installation Steps

Installing the fibre loop switch into an HP rack requires the following general steps:

- Step 1: Preparation

- Step 2: Mark the Rack Column Holes

- Step 3: Place the Barrel Nuts on the Rack Columns

    - Also install the "L" and "R" spacers on the front columns of HP Rack System/E and HP Rack System/U racks only.

- Step 4: Attach the Sleeves to the Front Rack Columns

- Step 5: Attach the Switch Rails to the Switch Chassis

- Step 6: Install the Switch

- Step 7: Complete the Installation

Step 1: Preparation

Before you install the switch into an HP rack, refer to the rack documentation as you extend the anti-tip foot or ensure that the anti-tip feature is installed. Lower the leveler feet.

Caution: Do the following to prevent the rack enclosure from tipping over. Failure to take these precautions could result in serious injury and equipment damage.
- Extend the anti-tip foot, or verify that the anti-tip feature is installed.
- Verify that the leveler feet are lowered.
- Do NOT extend more than one piece of equipment at a time out from the front of the rack.

Use the original ordering information to locate where each component goes in the rack. If the original ordering information is not available, use the HP Rack Assistant software to determine where to mount the switch in the rack.

Use tape or a marker pen to mark the bottom of the single EIA unit required by the switch. For EIA unit boundaries, refer to Figure 7 and Figure 8.

Figure 7: Marking Holes and Attaching Barrel Nuts on HP Systems Racks
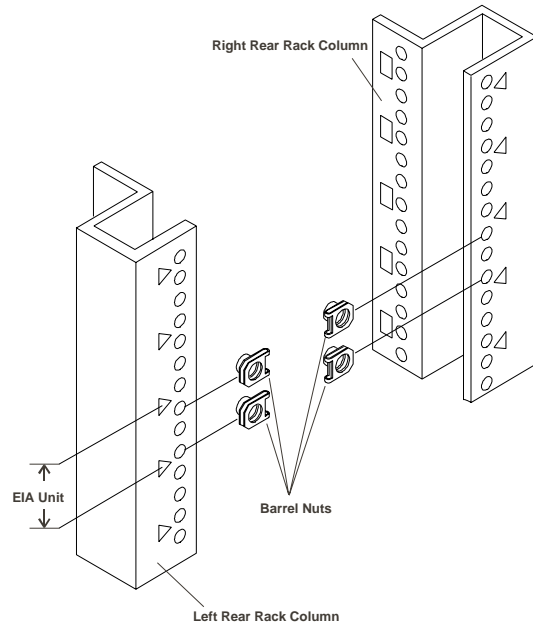
Figure 8: Marking Holes and Attaching Barrel Nuts on HP Rack System/E and HP Rack System/U Racks
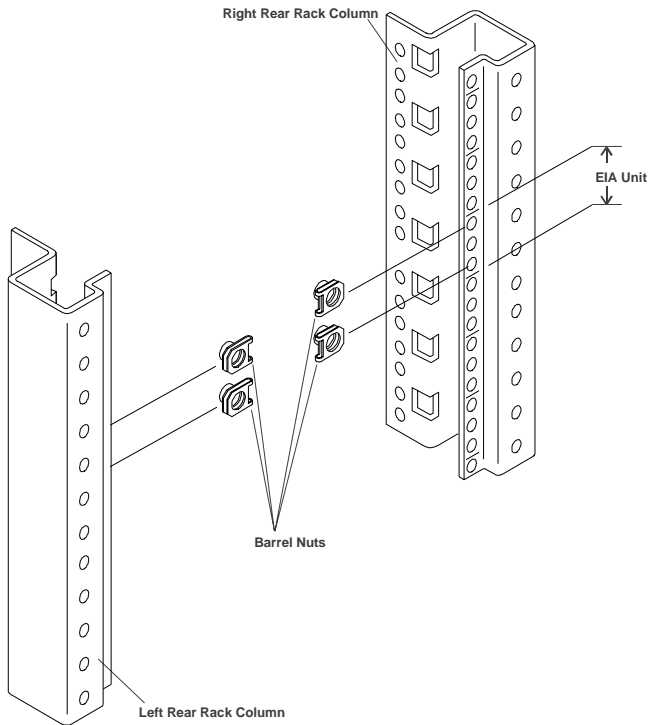
Step 2: Mark the Rack Column Holes

Use tape or a marking pen to mark the screw holes where you will install the barrel nuts:

- On each rear rack column, mark the top and bottom holes of the EIA unit on the inside of the column, as shown in Figure 7 and Figure 8.

- On each front rack column, mark the hole on the middle of the EIA unit on the inside of the column.

Step 3: Place the Barrel Nuts on the Rack Columns

1. **Identify the six barrel nuts by referring to Figure 7 and Figure 8.**

2. **Place two barrel nuts on each of the rear rack columns at the holes you marked, as shown in Figure 7 and Figure 8.**

➡ **Note:** Install the barrel nuts with the threaded nut part of the barrel nut on the inside face of the rack column.

3. **For HP Systems racks only, attach one barrel nut to each of the front rack columns at the holes you marked. For HP Rack System/E and HP Rack System/U racks do NOT attach barrel nuts to the front columns.**

Attach Spacers to HP Rack System/E and HP Rack System/U Racks

Use the spacers (shown in Figure 9) on HP Rack System/E and HP Rack System/U Racks only (product numbers J1500A, J1501A, J1502A, J1464A, and J1466A). Do NOT use them for HP Systems racks (product numbers J1487B and J1488A).

The spacers are marked "L" and "R" because they differ. Install them inside the front rack columns. Left and right front rack columns in the instructions below are as viewed from the rear of the rack.

• Put the "**R**" spacer on the **left** front rack column, as shown in Figure 9.

• Put the "**L**" spacer on the **right** front rack column, as shown in Figure 9.

➡ **Note:** The three holes in the spacer correspond to the three holes in the EIA unit. Align the middle hole in the spacer with the hole you marked on the front rack column.

Figure 9: Installing Spacers on HP Rack System/E and HP Rack System/U Racks
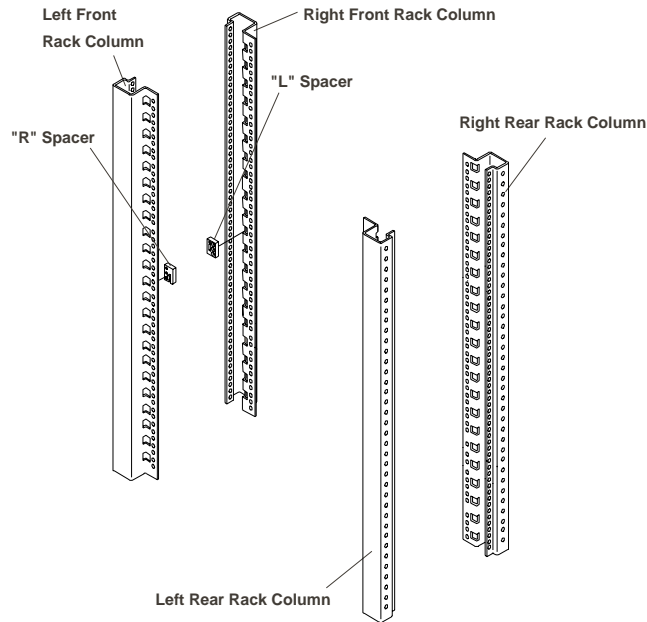
Step 4: Attach the Sleeves to the Front Rack Columns

When the installation is complete, each rack rail will consist of two parts, as shown in Figure 10 and Figure 11:

- A switch rail, which is mounted on the switch chassis and is later attached to the rear rack column
- A sleeve, which is mounted on the front rack column and which receives the switch rail

Attach the sleeves to the insides of the front rack columns, as follows:

1. **Identify the two sleeves, as shown in Figure 10.**

Figure 10: Identifying Switch Rails and Sleeves (Oriented for HP Racks)

Switch Rail

Sleeve

Sleeve Flange

Switch Rail Flange
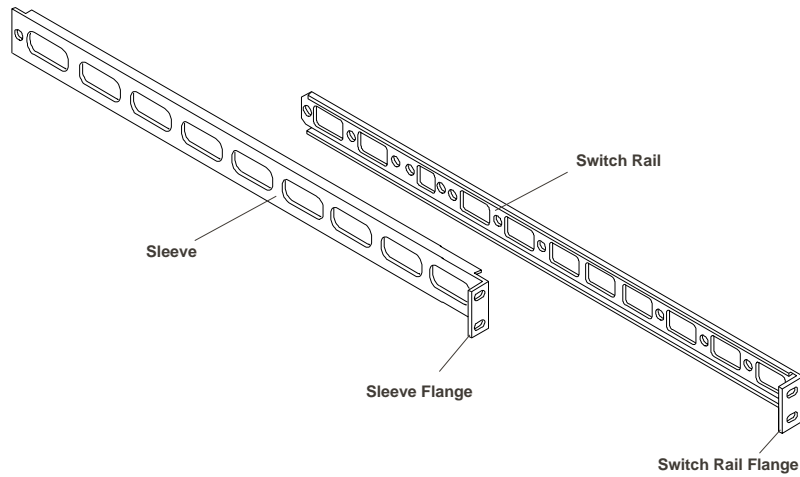
2.   Identify the six Torx screws.

Figure 11: Attaching Sleeves to an HP Systems Rack

Right Front Rack Column

Rack Nut

Rack Nut

Sleeve

Sleeve

Sleeve
Flanges

Left Front Rack Column
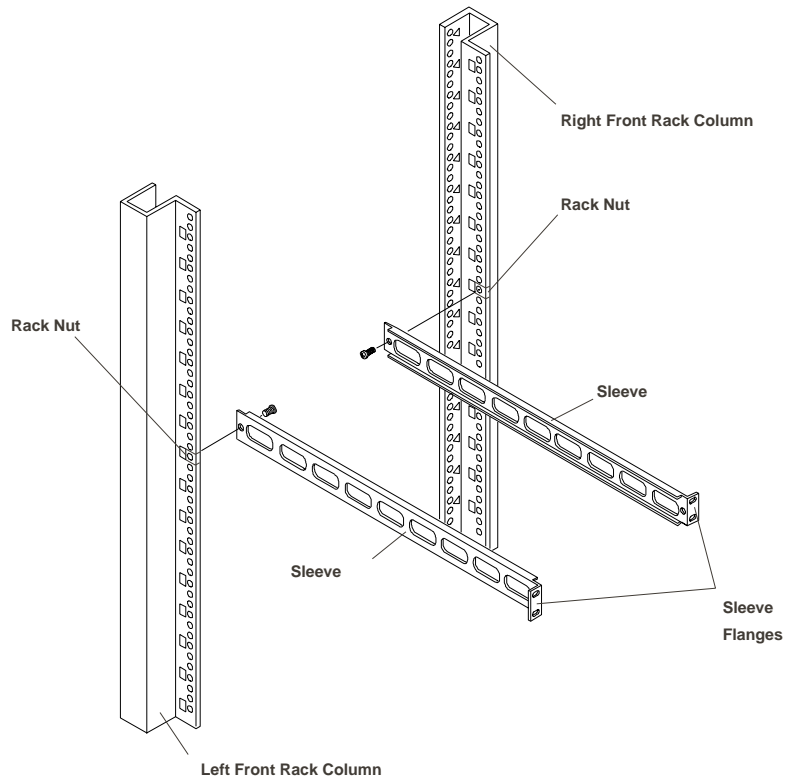
Figure 12: Attaching Sleeves to HP Rack System/E and HP Rack System/U Racks
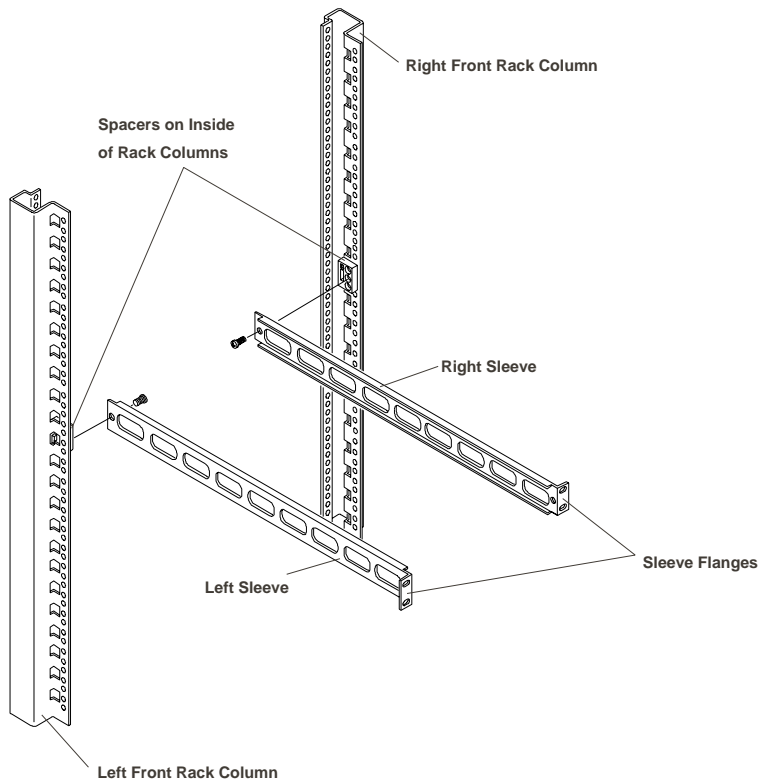
3.   **Position one sleeve on the inside of the rack front column with the sleeve's flange side toward the rack column, as shown in Figure 11 or Figure 12. Align the hole in the front end of the sleeve with one of the following holes:**

   • The rack column hole with the barrel nut on HP Systems rack.

   • The middle hole of the spacer on HP Rack System/E and HP Rack System/U racks.

4.   **Hold the sleeve firmly to the rack column, and insert one Torx screw through the sleeve and into the spacer or barrel nut, as shown in Figure 11 or Figure 12. Finger tighten the screw.**

5.   **Attach the other sleeve to the other front rack column in the same way.**

Step 5: Attach the Switch Rails to the Switch Chassis

1. **Remove the two side screws (one on each side of the switch chassis) that retain the cover, as shown in Figure 13. You will not use these short screws in the rest of this assembly.**

Figure 13: Securing the Switch Rails to the Switch
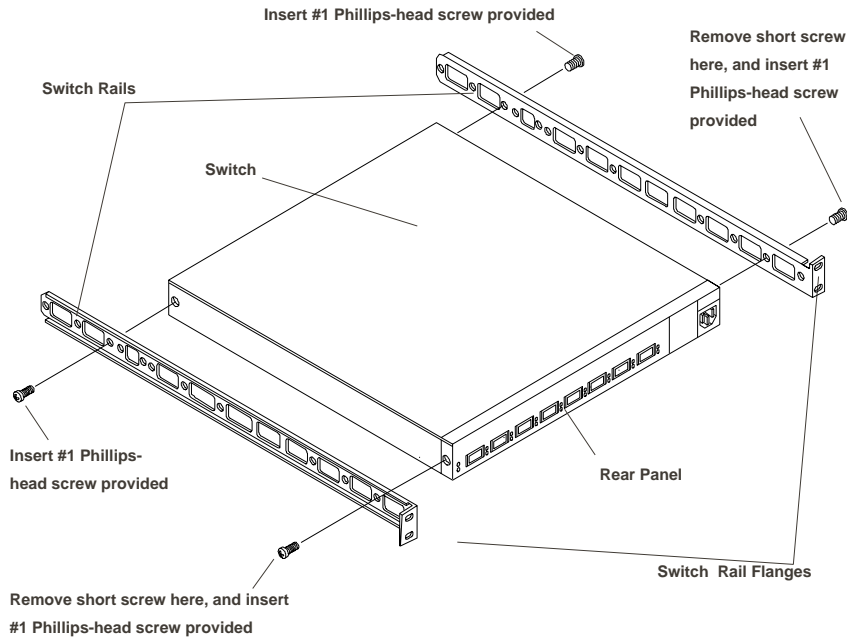
2. **Attach one of the switch rails to the side of the switch chassis with two of the #1 Phillips-head screws provided, as follows:**

    •   Orient one switch rail against the switch chassis as shown in Figure 13. The flange on the switch rail is on the outer side of the switch rail and near the rear panel.

    •   Align the holes in the switch rail with the screw holes in the switch chassis as indicated in Figure 13.

    •   Insert the two #1 Phillips-head screws through the switch rail and into the switch chassis as shown in Figure 13. Tighten the screws.

3. **Attach the second switch rail to the other side of the switch in the same way.**

Step 6: Install the switch

Have the remaining four Torx screws available as you install the switch.

1. **Pick up the switch chassis (with the switch rails installed) with the open switch rail ends away from you. Carry it to the rear of the rack.**

2. **Carefully align the switch rail ends with the open rack sleeves, and gently ease the chassis into the rack sleeves like a drawer, as shown in Figure 14 and Figure 15.**

3. **Align the two holes on one switch rail with the holes with the barrel nuts on the rear rack column, as shown in Figure 14 and Figure 15.**

4. **Attach that switch rail to the rear rack column with two Torx screws. The screws go through the flange on the switch rail first, and then into the barrel nut. Finger tighten the screws.**

Figure 14: Installing the Switch into an HP Systems Rack
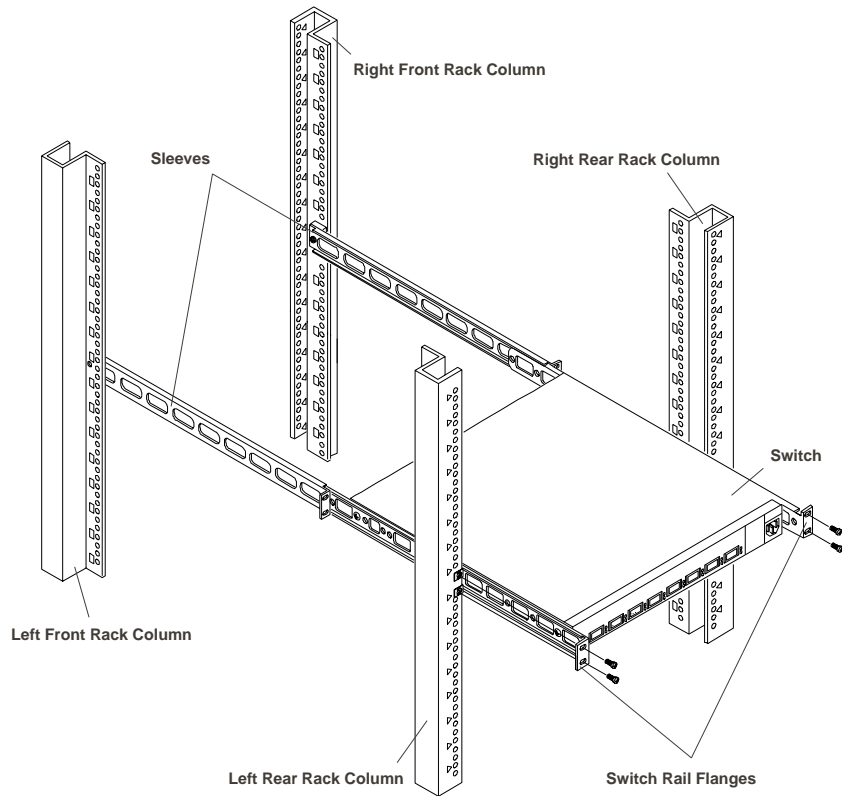
Figure 15: Installing the Switch into an HP Rack System/E or HP Rack System/U Rack
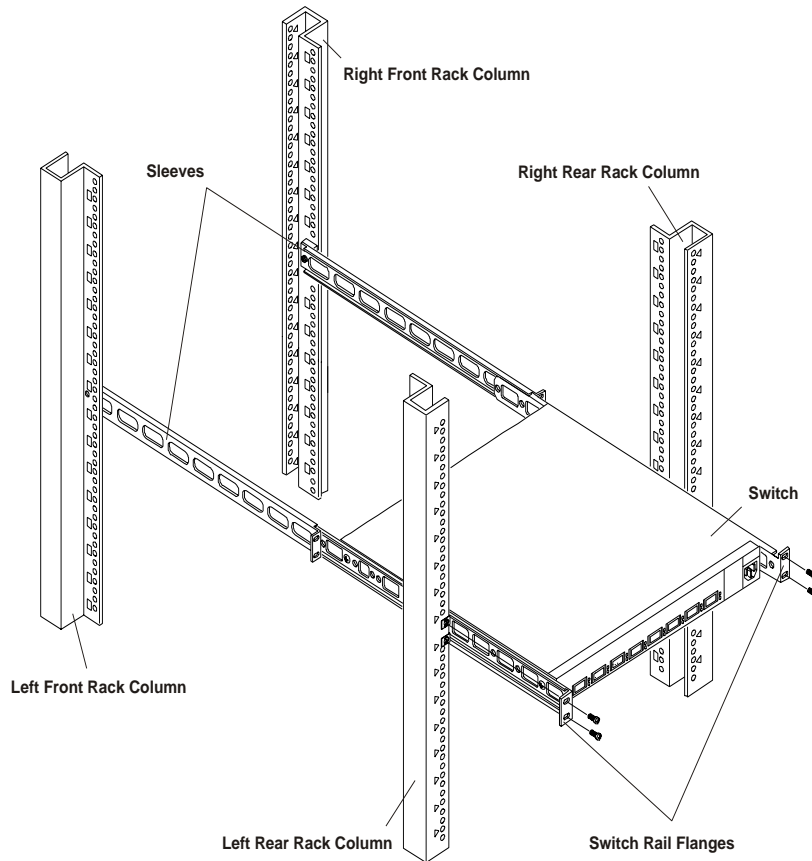
5. **Attach the other switch rail to the other rear rack column in the same way.**

6. **Use the T25 driver in a couple of passes to tighten all six screws that you installed in the rack columns.**

Step 7: Complete the Installation

1. **Connect the appropriate AC power cord to the switch.**

Plugging in the other end of the power cord will apply power to the switch. You can do either of the following:

- Connect the other end of the power cord to the power receptacle on the rack, which means you will hot-plug devices to the switch.

- Wait to plug in the other end of the power cord, so that you can connect devices to the switch before you power it.

2. **If you purchased a filler panel separately, install the filler panel on the front of the rack by pressing it into place, as shown in Figure 16.**

Figure 16: Installing the Filler Panel (Shown for HP Rack System/E and HP Rack System/U Racks)
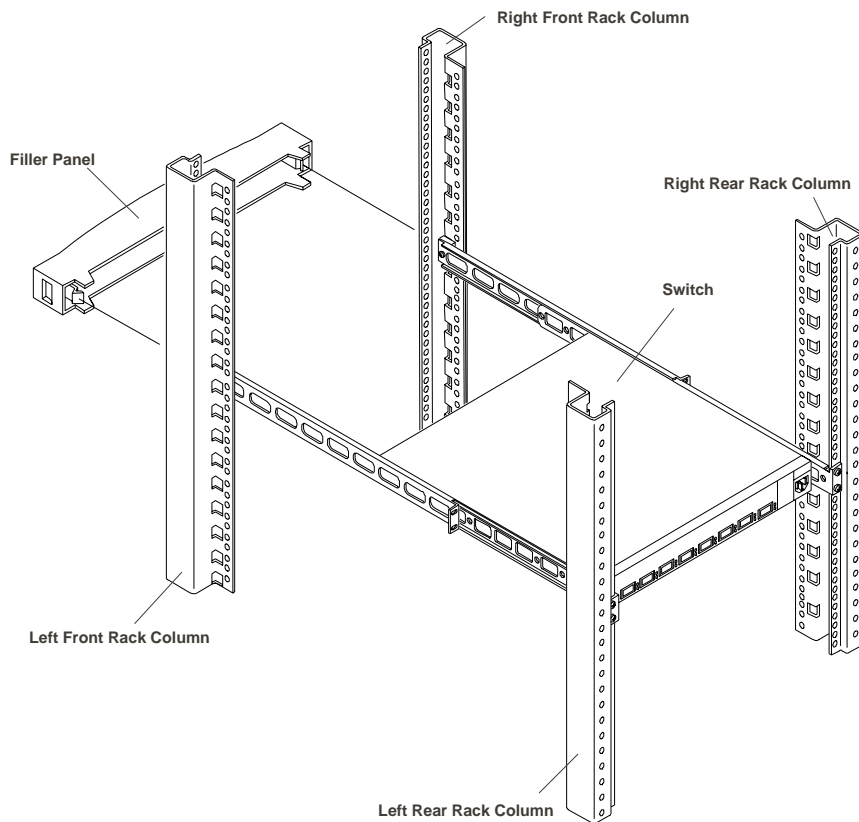
3. **Retract the anti-tip foot, if desired.**

Powering up a System

When bringing up an FC-AL system, first make all the connections with the equipment powered down, then turn on the fibre loop switch before turning on any other operating component. The fibre loop switch does not have an On/Off switch. For convenience and safety, connect the power cord to a grounded AC outlet near the rack or desk so it is easily accessible. Ensure that the appropriate power plug is available for the installation area.

1. **Plug the power cord into the loop switch's power receptacle, then plug the opposite end into a power receptacle.**

   On power-up or when you press the reset button, the switch runs several power-on self tests during start-up. The LEDs display changing patterns. See Table 1 on page 3 to interpret the LEDs as the switch comes up.

2. **Power on a host and I/O units.**

3. **Verify the presence of the I/O from units on the host.**

4. **Start the server application.**

Cabling for the Fibre Loop Switch

The fibre loop switch supports connection to multiple media formats.

➡️ **Note:** The following rules should be observed regarding cabling:
- Support and route the cables to prevent damage from sharp edges or from being crushed by nearby equipment.
- It is important to route copper cables so that they do not introduce noise. Don't lay them over transformers or alongside power cables for any distance.
- Provide support for installed cables, and do not allow them to have a bend radius of less than 3 inches (76 mm). This is particularly important with fiber optic cables as a sharp bend can decrease their performance even if they are not physically damaged.
- When connecting fiber optic cables together with a barrel connector, make sure that both fibers are the same mode and diameter.
- Laser types at each end of a link must match.

Cabling requirements for the fibre loop switch depend on the GBICs installed. Depending on the GBIC, it can support multi-mode fiber, single mode fiber, or

copper cabling. Table 3 provides the specifications for optical cable support and Table 4 provides the specifications for copper cable support.

Table 3: Optical cable requirements for the Fibre Loop Switch

Cable Spec	Multi Mode Fiber		Single Mode Fiber
Distance in Meters	2m–300m	2m–500m	2m–10Km
Fiber Core Size	62.5 µm (TIA standard for premise wiring for US and international use.)	50 µm (Not standard for premise wiring use. Proprietary point-to-point cabling use only.)	9 µm
GBIC Type	Shortwave laser	Shortwave laser	Longwave laser
Wave Length	780–850 nm	780–850 nm	1310 nm

Table 4: Copper cable requirements for the Fibre Loop Switch

Cable Spec	Value
Signal Level	FC Intra-Cabinet Standard
Connector Type	DB-9 or HSSDC
Distance in Meters	>10–33 m (equalized cable) 0–10 m (unequalized cable)

Chapter 3
Fibre Loop Switch
Troubleshooting

The following sections of this chapter provide information to help you troubleshoot problems with your fibre loop switch:

- General Maintenance Considerations
- Troubleshooting the Switch
- Reset Button
- Connections
- Temperature Control

General Maintenance Considerations

To protect the switch for longer use, we recommend that you:

- Periodically vacuum the external surfaces of the switch to remove dust.
- Do not drop fiber optic cable connectors onto hard surfaces. This can cause internal glass fractures and intermittent signals.
- Keep unused cable ends covered to prevent contamination from obscuring or attenuating the light signals
- Keep unused GBIC connections covered to prevent contamination from obscuring or attenuating the light signals.
- Always follow the GBIC manufacturer's recommended procedures for cleaning the GBIC. This is especially true of the type of solvent used for cleaning optical surfaces.

- Never insert foreign objects into optical transmit and receive ports.

- Do not bend fiber cable to less than a three-inch bend radius.

Troubleshooting the Switch

If there is a problem accessing a device connected to the fibre loop switch, the source of the problem can be with the device, the switch, the host, or any of the connections between the host and device. Follow the steps outlined below to investigate the problem. A description of possible symptoms and probable causes follows:

1. **Check the power LED.**

   If it is off, the unit may not be plugged into main power.

2. **Inspect the switch fault LED indicators for apparent problems.**

   If the fault LED goes on, the switch may be faulty or the temperature may be out of limits.

3. **Inspect the cabling between the switch and attached Fibre Channel devices.**

   Check for loose, dirty, broken, or bent cabling and connectors.

4. **If GBICs are in use, check that they are properly inserted and that their cables are properly seated.**

5. **Check the port status LEDs.**

Reading the LED Indicators

The LED indicators provide information about the status of the switch. These should be used as the first stage in troubleshooting. The various LEDs are interpreted by the following tables:

- Table 5 interprets the behavior that the Power, Fault and Initialization LEDs exhibit.

- Table 6 gives a generic description of the Port LEDs.

Table 5: Reading The Power, Fault, and Initialization LEDs

Label	LED Color/ Pattern	Interpretation	Possible Causes
Power	Green/ON	The unit is connected to an AC power source and the internal power supply is functioning.	This is the normal state when powered on.
	OFF	No power within the switch.	-The line has no voltage. -The switch is disconnected or the power cable is bad. -The switch is faulty.
Fault	Amber/ON	-Switch is running a self-test. -If the light remains on after 15 seconds, the switch failed the self-test or an environmental fault has occurred.	- This is the normal self-test state. -If the test fails, the switch may be faulty.
	OFF	Self-test completed with no fault found.	Normal running state.

Table 6: Reading The Port LEDs

Link (Green	Fault (Amber)	Interpretation	Possible Causes
OFF	OFF	No signal	Either: a. no GBIC has been installed or b. no cable with a valid signal has been attached since the GBIC was installed.
ON	OFF	Good Signal	Normal state for a valid port connection
OFF	ON	Port is bypassed	Bad signal or no signal.

Link (Green	Fault (Amber)	Interpretation	Possible Causes
ON	ON	Switch is resetting. Not a valid state at any other time.	Power up or a reset.

Reset Button

Use the reset button with caution. The Reset button on the front panel of the switch resets the internal control microprocessor of the switch. Sometimes a reset clears a problem that appears to be the result of an unidentified error. Pushing the Reset button interrupts all traffic and forces re-initialization of the loop. The switch bypasses all ports and goes through normal power-on operations. Then the switch reconnects the network by initializing all the ports connected to active devices. Resetting the switch disrupts the network. This may affect performance, but does not corrupt data on disk drives attached to the switch. It does, however, erase any statistics and other management data that have been collected.

Connections

The following subsections describe the handling of GBICs and Fibre Channel cables.

Caution: GBICs are sensitive to static electricity. Static discharge from your clothing or other fixtures around you can cause damage. To prevent damage to the GBIC, wear a wrist strap or discharge leash to free yourself of static before touching it.

- Leave the device in its antistatic bag until ready to install it.
- Hold the GBIC by its edges and handle it carefully.
- Always follow the GBIC manufacturer's recommended procedures for cleaning the GBIC. This is especially true of the type of solvent used for cleaning optical surfaces.
- Do not install any GBIC that appears physically damaged. This may result in permanent damage to the switch.

- Keep unused GBIC connectors covered with the plugs that are shipped with them to prevent contamination from obscuring or attenuating the light signals.

Fibre Channel Cables

The fibre loop switch uses Fibre Channel cables to communicate with cascaded and end-node devices. Loose or broken cables can cause a number of problems. Inspect the cabling between the switch and attached Fibre Channel devices. Check for loose, dirty, broken, or bent cabling and connectors.

1. **Inspect the switch fault LED indicators for apparent problems.**

2. **Check that the GBICs are properly inserted.**

3. **Check the port status LEDs.**

Temperature Control

As in the case of almost all commercial electronics, the fibre loop switch is designed to work in a normal room temperature environment, which is between 10º and 40º C. In order to maintain adequate cooling, the fibre loop switch is equipped with fans and a filler panel.

Fans

Three fans provide forced-air cooling and operate in parallel.

Caution: The air vents along the side and back panel of the fibre loop switch must not be blocked when installed. The operating temperature must be kept between 10 and 40 degrees Celsius (between 50 and 104 degrees Fahrenheit).

Filler Panel

The filler panel that came with the switch must be left in the back slot in order to direct the forced-air cooling. The GBIC slots have doors to serve the same purpose as the filler panel and they must remain closed if a GBIC is not installed.

Appendix A
Fibre Loop Switch
Functional Specifications

Switching

Switch Backplane Bandwidth..........12 Gigabits per second
Switching Mode..............................Non-Blocking
Port Speed......................................1.0625 Gigabits per second
Communication Modes ....Full or Half Duplex, Diplex
Port-to-Port Latency ....< 2 microseconds

Physical Specifications

Specifications that follow are without mounting hardware or GBICs.

Height ....1.66 in (42 mm)
Width ....17.3 in (439 mm)
Depth ....16.26 in (413 mm)
Weight with Power Supply ....10.681 lbs (4.85 Kg)

Environmental Specifications

Non-Operating

Temperature....................................−30º to +60º C
Relative Humidity ....10% to 90% non-condensing

Operating

Temperature....................................+10º to +40º C
Relative Humidity ....20% to 80% non-condensing
Acoustic Noise Emissions ....<46 dBA

Electrical Specifications

AC Voltage ....100–240 VAC autosensing
Frequency ....50 to 60 Hz
Rated Input Current ....1.5A — 0.7A

LED Specifications

Front Panel LED Indicators

Power..Green
Fault...Amber
Init...Green

Port LED Indicators

Link..Green
Fault...Amber

Fibre Channel Communications

Media...DB-9 Copper, HSSDC Copper, SW Optical
                                               Dual SC, GBIC
Protocol and Standards ....FC-AL, FC-AL-2, FC-PH, FC-PH-2,
                                               FC-PH-3, FC-PLDA, FCP

Regulatory Certification

Safety Compliance

USA ....UL 1950, 1995 3rd Edition
Canada ....CSA C22.2 No. 950-95, 3rd Edition
European Union (EU)
and Nordic ....EN 60950: 1992 A1/A2/A3/A4/A11
                                               EMKO-TSE (74-SEC) 207/94
Other Countries: ....IEC 60950: A1/A2/A3/A4

EMC Compliance

USA ....FCC Title 47 CFR, Part 15, SubpartB; 1998,
                                               Class A
Canada ....ICES-003, Class A

European Union (EU)......................EN 55022: 1994 +A1 +A2, Class A
                                        EN61000-3-2: 1995
                                        EN61000-3-3: 1995
                                        EN 55024: 1998
Japan...VCCI V3: 1997, Class A
                                        JEIDA Guideline for the suppression of
                                        harmonics: 1993
Australia/New Zealand....................AS/NZS 3548/95, Class A
Other Countries ....CISPR 22: 1997, CISPR24:1997

Appendix B
Regulatory Information

Regulatory Notices

Electromagnetic Compliance

Electromagnetic Compatibility (EMC) requirements have been established in many countries to regulate the radio frequency energy generated by Information Technology Equipment (ITE). This energy is generated during the normal and intended use of this equipment and so it is limited by country regulations to levels intended to minimize potential interference to other electrical equipment, including public safety services.

Two levels of radio frequency energy are allowed according to the type or use of equipment. Class A levels have been established for use in commercial or business environments. Class B levels are lower than the Class A requirement and have been established for use in residential environments. Class B levels are also suitable when the environment includes electrically sensitive equipment.

The fibre loop switch that you have purchased has been provided with compliance labels to indicate where it may be used with reasonable protection to the environment in which it is used. Additional statements are provided below as required by the requirements of international and domestic regulations.

Wire connections to GBICs installed in this product must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC rules and regulations.

➡ **Note:** Check the label on your product to determine the level of operation.

Notice for United States

Class A Equipment

This equipment has been tested and found to comply with the limits for Class A digital devices, pursuant to Part 15 of the FCC (Federal Communications Commission Rules). These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at their own expense.

Class A Accessories

Installation and use of a Class A accessory creates a system that meets the requirements for industrial and commercial environments. If you are installing a Class A accessory in a system that has been labeled as a Class B product, the requirements and notice for Class A equipment shall be applied.

Notice for Canada

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Notice for Japan

For products labeled as Class A:

This equipment is in the Class A category information technology equipment based on the rules of Voluntary Control Council For Interference by Information Technology Equipment (VCCI). When used in a residential area, radio interference may be caused. In this case, user may be required to take appropriate corrective actions.

この装置は，情報処理装置等電波障害自主規制協議会（ＶＣＣＩ ）の基準に基づく クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Notice for Korea

Class A Warning

Please note that this equipment has been approved for business purposes with regards to electromagnetic interference, if purchased in error for use in residential area, you may wish to exchange the equipment where you purchased it.

A급 기기 :

이기기는 업무용으로 전자파 장해검정을 받은 기기이오니 판매자 또는 사용자는 이점을 주의 하시기 바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에서 비업무용으로 교환하시기 바랍니다.

Notice for Taiwan

Class A Warning

警告使用者:
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Notice for European Union

Radio Frequency Emissions Warning for Accessories

This product has been found to comply with CISPR 22 Class A EMC emission limits. Installation and use of a Class A accessory creates a system that meets the requirements for industrial and commercial environments. However, in a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Declaration of Conformity (US and EU)

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's/Supplier Name:	Hewlett-Packard Company
Manufacturer's/Supplier Address:	10955 Tantau Avenue Cupertino, Ca 95014 USA

declares, that the product

Product Name:	HP 8-Port Fibre Loop Switch
Model Number(s):	P4459A
Product Options:	All

conforms to the following Product Specifications:

Safety: IEC 60950: 1991 +A1, A2, A3, A4/ EN 60950: 1992 + A1, A2, A3, A4, A11
GB4943-1995

EMC: EN 55022: 1998/CISPR 22:1997, ITE Radiated and Conducted Emissions
CFR 47 Part 15, Subpart B, Unintentional Radiators, Radiated and Conducted Emissions
EN 61000-3-2: 1995 +A1: 1998, Harmonic Current Emissions
EN 61000-3-3: 1995, Voltage Fluctuation and Flicker

EN55024: 1998/CISPR 24: 1997
EN 61000-4-2/IEC 61000-4-2: 1995, ESD
EN 61000-4-3/IEC 61000-4-3: 1995, Radiated Immunity
EN 61000-4-4/IEC 61000-4-4: 1995, Fast Transient/Burst
EN 61000-4-5/IEC 61000-4-5: 1995, Surge
EN 61000-4-6/IEC 61000-4-6: 1996, Conducted Immunity
EN 61000-4-11/IEC 61000-4-11: 1994, Voltage Dips and Interruptions

Supplementary Information:

1) The product was tested in a typical configuration.

2) The product complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
   • This device may not cause harmful interference, and
   • This device must accept any interference received, including interference that may cause undesired operation.

The product herewith complies with the requirements of the following directives and carries the CE-marking accordingly:
   - EMC Directive 89/336/EEC including Ce Marking Directive 93/68/EEC
   - Low Voltage Directive 73/23/EEC
Cupertino, March 1, 2001
North American Contact: Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304
650-857-1501
European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH
Department ZQ/Standards Europe, Herrenberger Straße 130, D-7030 Böblingen,   (FAX: + 49-7031-14-3143)
Quality Management Services & Systems Phone ++613 9272 8355

Regulatory Notices - Product Safety

This product may be equipped with a Hewlett-Packard Optical GBIC containing a laser. In which case the GBIC is a Class 1 Laser Product per US/FDA/CDRH (21 CFR) and per IEC-825-1 (EN60825-1 and A11).

Laser Safety– United States

CAUTION	This device contains a laser system and is classified as a "Class-1 Laser Product" under a U.S. Department of Health and Human Services (DHHS) Radiation Performance standard according to the Radiation Control for Health and Safety Act of 1968. To ensure proper use of this product, please read this instruction manual carefully and retain for future reference. Should the unit ever require maintenance, contact an authorized service location.

WARNING	Use of controls, adjustments or the performance procedures other than those specified herein may result in hazardous radiation exposure. To prevent direct exposure to laser beam, do not try to open the enclosure

Laser Safety - Finland

- LASERTURVALLISUUS
- LUOKAN 1 LASERLAITE
- KLASS 1 LASER APPARAT

Laser Safety - Germany

> VORSICHT Diese Gerät enthält ein Laser-System und ist als "LASER
> PRODUKT DER KLASSE 1"klassifiziert. Für den
> richtigen Gebrauch dieses Modells die
> Bedienungsanleitung sorgfältig durchlesen und als
> Referenz aufbewahren. Falls Probleme mit diesem Modell
> aufreten, die nächste "authorisierte Services-Verrtetung"
> benachrichtigen. Um einen direkten Kontakt mit dem
> Laserstrahl zu vermeiden, soll das Gehäuse nicht geöffnet
> werden.

> VORSICHT Die Verwendung von anderen Steuerungen oder
> Einstellungen oder das Durchführen von anderen Vorgängen
> als in der Bedienungsanleitung beschrieben kann
> gefährliche Strahlenexpositionen zur Folge haben

| CLASS 1
LASER PRODUCT | This Fibre Loop Switch Unit is classified as a CLASS 1 LASER PRODUCT. |
| LASSER KLASSE 1
PRODUKT | |

Appendix C
Warranty and Support

The hardware warranty below applies to components purchased as accessories. If your component was factory installed as part of an HP Netserver model, refer to the *HP Netserver Warranty and Service/Support Booklet* for the warranty limitations, customer responsibilities, and other terms and conditions.

Hardware Accessories Limited Warranty

Hewlett-Packard Hardware Accessories

An HP Netserver Hardware Accessory is an internal HP hardware product that is specifically designated for use with HP Netservers; is added on or integrated into an HP Netserver in order to provide higher performance, capacity, or increased capability; and is listed as a product in HP's Corporate Price List. Upon installation inside an HP Netserver, the HP Netserver Hardware Accessory carries a System-Matching Warranty. This warranty includes a one-year Return-to-HP warranty or the remainder of the warranty period for the original HP Netserver in which it is installed, whichever is longer.

This accessory may be serviced through expedited part shipment. In this event, HP will prepay shipping charges, duty, and taxes; provide telephone assistance on replacement of the component; and pay shipping charges, duty, and taxes for any part that HP asks to be returned.

HP warrants this HP Netserver Hardware Accessory against defects in material and workmanship, under normal use, for the period specified in the section titled HP Netserver Limited Warranty Coverage. The warranty commences on receipt of this product by Customer from HP or Reseller. If HP or Reseller receives

notice of such defects during the warranty period, HP or Reseller will either, at its option, repair or replace products that prove to be defective.

Should HP or Reseller be unable to repair or replace the hardware accessory within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the hardware accessory product.

HP products external to the system processor unit, such as external storage subsystems, printers, or other peripherals, are covered by the applicable warranty for those products. HP SureStore drives are considered external accessories and carry their own warranty.

The customer may be required to run HP-supplied configuration and diagnostic programs before a replacement will be dispatched or an on-site visit is authorized.

Third-Party Hardware Products

HP does not warrant third-party hardware products. Third-party hardware products may be warranted in accordance with the third-party warranty statement accompanying the product. On-site visits caused by third-party hardware products—whether internal to the HP Netserver system processor unit (such as non-HP DIMMs) or external to the system processor unit (such as LAN cabling)—are subject to standard per-incident travel and labor charges.

HP Repair and Telephone Support

U.S. and Canada

For hardware repair or telephone support in the U.S. and Canada contact HP Customer Support Center (Colorado) (970) 635-1000 (24-hours a day, 7-days a week).

Other Countries

Refer to the *HP Netserver Warranty and Service/Support Booklet* supplied with your HP Netserver system documentation for instructions on how to obtain HP repair and telephone support.

World Wide Web

On the World Wide Web go to:
`http://netserver.hp.com/netserver/`

Glossary

This glossary contains terms and acronyms that may be found in this documentation.

AL_PA

Arbitrated Loop Physical Address. The low-order byte of a 3-byte Fibre Channel Source/Destination ID field that defines an address hierarchy. This is also called a Loop ID. See D_ID or S_ID.

AL_PD

A destination AL_PA.

AL_PS

A source AL_PA.

ANSI

American National Standards Institute, the organization that coordinates voluntary standards for programming languages, telecommunications, properties of disk and tape media, and more, in the United States.

Arbitrated Loop

A Fibre Channel standard defining a loop topology where up to 126 devices communicate with one another using an arbitrated access protocol.

Arbitration

The process of selecting one respondent from a collection of several candidates that request service concurrently.

Area

See Fibre Channel Address.

Bandwidth

The amount of data per second that can be transferred from one device to another. Bandwidth limits are set by a combination of speed of transfer, capacity of the pipe, number of pipes, and overhead of sending the data. It is possible to transmit one signal at the maximum specified bandwidth, or several different signals simultaneously on different channels, each of them using a portion of available bandwidth.

BLS

Basic Link Services (also known as Link Service). A Fibre Channel request/response protocol common to all devices. The most universally implemented Basic Link Service is Abort Sequence (ABTS), used for error recovery.

Broadcast

A transmission sent to all N_Ports on a network.

Bypassed port

A port status that indicates a port is not enabled on a loop, even though the port is still physically connected to the network. A bypass can be automatic or manual.

Channel

A pathway between components in a computer system or between workstations in a network.

Cluster

A group of systems that work together as a single system to provide fast, uninterrupted service. It is a way to increase capacity and to add I/O bandwidth.

Credit

A numeric flow control value that establishes advance permission to send one or more frames. It is used for either end-to-end or buffer-to-buffer Class-2 frames. As long as a port has a credit of greater than 0, it is able to continue to send frames. Credit is granted by a port during the login process.

Datagram

Datagram refers to an unacknowledged Fibre Channel frame or frame sequence, borrowed from networking terminology. The Fibre Channel standards use it specifically to refer to the type of unacknowledged service defined by Class 3 delivery.

Device

See FC-AL Device.

D_ID

Destination ID. A Fibre Channel Address of a frame defining the destination node for that frame.

Diplex Communications

In addition to full duplex communications between a pair of nodes, a node can receive from another node, while simultaneously transmitting to a third node independently.

Domain

See Fibre Channel Address.

Duplex (full)

Operation of a data communication link where transmissions are possible in both directions simultaneously.

Duplex (half)

Operation of a data communication link where transmissions are possible in both directions, but only in one direction at a time.

ELS

Extended Link Services support messaging protocol for discovery and dynamic address partitioning.

EMC

ElectroMagnetic Compatibility.

Embedded Node Agent

An in-band Node Agent conducts automatic discovery and display of SCSI and SES targets, SES enclosures.

Enclosure

The box, rack, or set of boxes containing one or more devices. It can provide power, cooling, and other support functions to the devices.

E_Port

Expansion Port. It specifies the interconnection and initialization for a Fibre Channel switch to create an inter-switch link. It is similar to an N_Port and an F_Port.

Fabric

Fibre Channel-defined interconnection methodology that handles routing in Fibre Channel networks.

FC-0

The set of Fibre Channel standards that address media (optics, copper, connectors), and physical signalling over that media (signal rates and timing, signal quality, power, jitter, etc.).

FC-1

The set of Fibre Channel standards that address 8B/10B encoding/decoding and transmission protocol.

FC-2

The set of Fibre Channel standards that address link protocols: framing, flow control, link services, and error recovery.

FC-3

The set of Fibre Channel standards that define additional services which are available to all FC-4 protocols, yet are not part of the link layer.

FC-4

The set of Fibre Channel standards that define the mapping of higher level protocols (primarily IP and SCSI initially) to Fibre Channel link protocols and services.

FC-AL Device

A device that employs Fibre Channel-Arbitrated Loop and consists of one or more NL_Ports.

FC-PH

Fibre Channel Physical standard consisting of three lower levels, FC-0 physical, FC-1 encoding, and FC-2 framing and signalling.

FC-SW

Fibre Channel Switch standard that specifies tools and algorithms for interconnection and initialization of Fibre Channel Switches to create a multi-switch Fibre Channel fabric.

Fiber

Refers to the strands of glass through which data in the form of light pulses are transmitted in fiber optic cable. It is used for high-speed transmission over medium to long distances.

Fibre

An FC-AL term used to cover all transmission media types specified in the Fibre Channel Physical Layer standard (FC-PH), such as optical fiber, copper twisted pair, and copper coaxial cable. Fibre is not exclusively optical fiber.

Fibre Channel (FC)

> An ANSI T11 standard which provides high-speed, high-reliability data transfers among computing devices, storage devices, and networked equipment. It defines a bi-directional, full-duplex serial data channel at speeds of 1 Gigabit per second and higher, over distances up to 30 km. Current implementations support the transport of SCSI and IP protocols over switched and loop network topologies.

Fibre Channel Address

> A 3-byte address defining a destination or source node (N_Port, NL_Port, etc.) There are 256 ports within each Area (only half of which are usable on FC-AL), 256 Areas within each Domain, and 256 Domains.

Table 7: Fibre Channel Address

Bits 23-16	Bits 15-8	Bits 7-0
Domain Address	Area Address	Loop Address

Fibre Channel Arbitrated Loop (FC-AL)

> A Fibre Channel workgroup topology supporting up to 126 devices without the use of fabric protocols. Media access is performed through arbitration. Switching and fabric features can be supported through the use of infrastructure products such as hubs, switches, bridges, routers, and embedded management agents and services.

F_Port

> Fabric Port. A port on a fabric switch to which N_Ports may be directly connected. The F_Port is not capable of communicating with FC-AL protocol.

FL_Port

> Fabric Loop Port. An F_Port that is capable of supporting an attached Fibre Channel Arbitrated Loop. An FL_Port on a loop will have the AL_PA hex'00' giving the fabric the highest priority access to the loop. N_Ports or NL_Ports can attach to it in an Arbitrated Loop topology and are capable of communicating with FC-AL protocol.

FPGA

> Field Programmable Gate Array is a hardware device to which you download code that determines the set of capabilities for that device.

Full Duplex Communications

A pair of nodes able to both simultaneously send and receive data between each other for an aggregate of 2 Gbps, effectively doubling the communications rate between the two nodes.

Frame

The smallest unit of information carrying user data and protected by Fibre Channel error control and recovery. Up to 2112 bytes per frame can be transported.

GBIC

Gigabit Interface Converter. It is a connector that offers flexible choice of media and transmission technology.

Gigabit

One billion bits or one thousand megabits. It is generally used to refer to bandwidth.

HBA

Host Bus Adapter is a card that connects FC peripherals and server host buses such as PCI and others. It also requires a device driver.

Hub

A central connecting device in a network that joins communication lines into a star configuration.

In band

"In bandwidth." Using the same bandwidth (wires or data channel) for signaling as for data transmission.

IP

Internet Protocol. A protocol designed for use in interconnected systems of packet networks.

Jitter

Unwanted variations in the frequency or phase of a digital or analog signal due to varying time delays in the circuit paths from component to component in the signal path. Jitter can cause errors and data corruption.

LAN

Local Area Network. A communications system whose geography covers less than 5 kilometers. Transmissions within it are mostly digital, carrying data among stations at rates usually above 1 Mbit/sec.

Latency

The time delay of data traffic through a network or a switch.

LILP

Loop Initialization Loop Position map is the accumulation of all of the information reported in the LIRP frames. It is optionally sent out by the initialization master at the end of the initialization sequence.

Link

In this context, it is a pair of fibers (RX for inbound and TX for outbound) that carries information to and from a port. It is also called a channel.

LIP

Loop Initialization Primitive. A Fibre Channel Primitive Sequence transmitted by FC-AL devices and infrastructure to signal a potential topology change, and to put all devices attached to a loop into the same state for the purposes of Loop Initialization and Loop Address administration. It can include LISM, AL_PA assignment, and building a positional map of the loop.

LIRP

Loop Initialization Report Position establishes a position map which is a table of all the AL_PAs on a node. See also LIFC.

LISM

Loop Initialization Select Master is the process used to determine the temporary loop master as part of the LIP.

Long Wave

Lasers or LEDs that emit light with wave lengths around 1300 nm. Long wave lasers are used for long Fibre Channel links, from ~700-2000m. They are typically used with single-mode fiber with a 9-micron core size.

Loop ID

A unique 7-bit value from 0 to 126 that represents the 127 valid AL_PAs (physical addresses) on a loop.

Loop Tenancies

The time required for a data transfer to be completed. An FC node wanting to send data starts a loop tenancy by arbitrating for ownership of the loop. Upon winning arbitration, the device wanting to send data opens a communication channel to its intended destination. When the destination device responds that it has available buffer space, the sender sends data until it is finished. After the data transfer is complete, the sender closes the loop tenancy.

L_Port

Loop Port. It only has the capability to communicate over FC-AL hubs and through FL_Ports.

LPSM

Loop Port State Machine. It resides on each loop-capable port and is responsible for performing the loop protocols and the repeater function to pass information through.

MAC Address

Media Access Control address. It is the 48-bit (12 digit hexadecimal), IEEE 802.1, Universal LAN MAC address (ULA). It is constructed from the 24-bit IEEE company ID and a 24-bit vendor-specified identifier associated with an Ethernet port. It is also used to construct the Worldwide Name.

Managed Object

A data variable that represents a resource or other aspect of a managed device.

MIB-II

Management Information Base. A set of inter-related managed objects. The attributes of these objects have network monitoring values whereby an SNMP agent can access management instrumentation and at least one management station from where a network manager can collect statistics and a management protocol to exchange information between the agents and the management station.

Mirroring

The technique of duplicating the data from one disk onto another in real time, so that if the primary drive fails, data is immediately recoverable from the secondary drive. Mirroring is also known as RAID-1. The advantage is that it is simple and does not necessarily require an array controller, and it is fast to store and recover. The disadvantage is that it is the least efficient of the RAID types since it requires twice the amount of storage as simple direct storage.

Multicast

Data that is sent to a group of N_Ports in a fabric in parallel.

Network

A collection of interconnected components and the protocols and physical methods those components use to communicate. Network components consist of network elements (infrastructure components) and network attachments (devices which use the network to communicate). A Storage Area Network is a network whose elements consist of computing devices, storage devices, and storage subsystems. The predominant SAN protocol used is currently Fibre Channel.

NL_Port

Node Loop Port. It has the capability to communicate over both FC-AL hubs and through F_Ports.

Node

A node is a device that has at least one N_Port or NL_Port to provide access to a Fibre Channel SAN.

N_Port

Node Port. It only has the capability to communicate through an F_Port. It is a port on a computer, disk drive, etc., through which the device does its Fibre Channel communication as a direct fabric-attached port for use with point-to-point or fabric topology. It is identified by a Worldwide Name.

N_Port ID

The Fibre Channel Address that a node sends in the S_ID of each frame it sources, and the Fibre Channel Address that a node responds to in the D_ID of each frame it receives. If a Fibre Channel node receives a frame which contains a D_ID not equal to its N_Port ID, it is considered a delivery error and the frame is discarded. See Table Table 8: for its structure.

Table 8: N_Port ID

Byte 2 Bits 23-16	Byte 1 Bits 15-8	Byte 0 Bits 7-0
Domain	Area	Loop (AL_PA)

OFC

Open Fibre Control is a defunct FC-0 signalling protocol used to provide eye safety for optics which are not intrinsically eye safe based on their optical power. All interoperable Fibre Channel ports use non-OFC optics.

Out-of-band

Using a separate channel for signaling to ensure full bandwidth availability for its primary purpose. For example, although more costly, it ensures full bandwidth availability for voice or critical data transmission.

PLDA

Private Loop Direct Attach. A profile that defines an interoperable FC-AL implementation.

Port

A hardware pathway into and out of a node that performs data communications over the FC link. For example, a "dual-ported" device has two separated pathways by which data is transferred.

Private Loop

A Fibre Channel Arbitrated Loop that stands on its own and is not connected to a fabric.

Protocol

A set of conventions or rules used by a program or operating system to communicate between two or more endpoints. Examples include IPX, TCP/IP, and AppleTalk. Though the protocols differ, they all allow information to be packaged, sent from a source, and delivered to a destination system.

Public Loop

A Fibre Channel Arbitrated Loop that is connected to a fabric.

RAID

Redundant Array of Inexpensive Disks. It is a disk subsystem that appears as a single, large, fast disk drive, even though it is in reality composed of an array of drives.

RFI

Radio Frequency Interference.

Ring

A configuration of computing devices interconnected in a ring shape. The communication between any two points always includes all of the intermediate points.

Router

A device connected to two or more networks that decides to which network to send the data. It is often used in SANs to connect SCSI devices to Fibre Channel networks.

SAN

Storage Area Network. This concept brings networking to storage. It is a highly scalable, managed, server-storage infrastructure that offers gigabit speed data connectivity, high system availability, extensive fault tolerance, and low cost of ownership.

Scalability

The ability of a system to incrementally increase connectivity and performance.

SCSI

Small Computer System Interface. There are several variations that range from an 8-bit interface for up to 7 peripherals to a 16-bit interface for up to 15 peripherals. It is commonly used for many types of peripherals such as disks, printers, scanners, and just about anything else.

Short Wave

Lasers or LEDs that emit light with wave lengths around 780 nm or 850 nm. Short wave lasers are used for FC-AL links up to ~700m. They are typically used with multimode fiber. A fiber core size of 50 microns provides greater performance than 62.5 micron fiber, which is supported for compatibility with existing wiring networks, for example, FDDI.

S_ID

A Fibre Channel Address of a frame defining the source node for that frame.

SNMP

Simple Network Management Protocol. A protocol used to examine and change configuration parameters and counters of network-connected devices. Agents (software running in the monitored/controlled devices) communicate with management consoles and store variables as counters or in simple tables. The variables are defined by MIBs.

SNMP Agent

A management entity consisting of hardware and embedded software which responds to SNMP requests over Ethernet from an SNMP manager.

Star

A configuration of computing devices within a LAN where each user is connected by links radiating out from a central connection point such as a hub.

Switch Port

A port on a device that can directly connect two devices together through switch connection. The P4459A is such a switch.

Topology

The physical or logical layout of nodes on a network.

WWN

Worldwide Name. It defaults to the lowest value MAC Address assigned to any port.

WW Port Name

Worldwide Port Name. To ensure global uniqueness, the MAC Address prepends 16 bits to create a 64-bit identifier. The first 4 bits are a Network Address Authority (NAA) controlling authority identifier. The next 12 bits are 0-padded. When NAA=1, it means that the WW Port Name follows IEEE 802.3A Universal LAN MAC addressing. Fibre Channel requires each port to assign an unchangeable WW Port Name. See MAC Address.

ULP

Upper Layer Protocol. The protocol that runs on top of Fibre Channel through the FC-4 layer. Well known ULPs that run over Fibre Channel are SCSI and IP.

Zoning

The ability to divide a SAN into a number of independent zones for binding targets to initiators. This allows a logical mapping of a physical configuration.